Predictors of HIV sero-status among drug injectors at three Ukraine sites

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Objective: To assess the HIV serostatus of injection drug users (IDU) in Ukraine, as well as associations between serostatus and selected demographic and risk factors.

Design and methods: IDU were recruited from the streets in Kiev, Odessa and Makeevka/Donesk. Participants were interviewed using an HIV risk behavior assessment and tested for HIV with a finger-stick rapid test. Multiple logistic regression was used to identify determinants of HIV infection.

Results: Of the 891 IDUs surveyed, one-third came from each site and 22% were female. Their mean age was 29 years and on average they had been injecting for slightly more than 10 years. Seven hundred and seventy-eight of the total sample did not know their HIV status when first interviewed; they are the participants in this investigation. Overall, 33% tested positive for HIV, including 34% in Kiev, 51% in Odessa and 17% in Makeevka/Donesk. Independent predictors of HIV included injecting a sedative/opiate mixture, female sex, having sex with a person who was HIV positive or whose HIV status was unknown and injecting daily. HIV-negative IDU were significantly younger than those infected, they were more likely to be from Makeevka/Donesk and they were more likely to have been sexually active.

Conclusions: Rates of HIV infection among IDU vary considerably across Ukraine, although even in the site with the lowest rate nearly one in five was infected. The extent of drug and sex-related risk behaviors calls for interventions to reduce the spread of HIV and other infectious diseases.

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Introduction

Ukraine is at the epicenter of HIV in all of Europe with an estimated 250 000–500 000 adult and children infected, most of whom are drug injectors [1–3]. Yet as late as 1994 the World Health Organization (WHO) estimated there were just 1500 cases of HIV in Ukraine, primarily due to heterosexual transmission [4], and in 1995 they described Ukraine as a low prevalence country [5]. In all likelihood the epidemic began in 1995, as within a year all 25 regional capitals in Ukraine reported cases of HIV, fueled largely by drug injectors [4] who by 1997 accounted for 85% of all infections [1]. Some health officials believe that by 2010 there may be as many as 1.5 million infected individuals [6]. This perception is due to the recent expansion of the epidemic to non-drug injectors through sexual transmission. HIV infection attributable to heterosexual transmission accounted for more than a quarter of all new cases reported in the first half of 2002 [1].

The injection practices of injection drug users (IDU) in Ukraine play a key role in the rise of HIV [7]. The drugs most commonly injected are opiate poppy straw and ephedrine [8]. Poppy straw is usually obtained in a liquid form in pre-loaded syringes, or from drug dealers who are typically also IDU [9]. When purchased from dealers, it is drawn up from a common container with the user's

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syringe or, if the dealer's syringe is used, the solution is front or back loaded from the dealer's syringe into the user's syringe [8,9]. Ephedrine, on the other hand, is typically purchased from pharmacies by groups of IDU who prepare the solution and inject together [9–11]. HIV could be spread through contaminated containers used to mix the solution, as well as through injection equipment used to distribute the solution [12]. The present investigation was designed to assess the characteristics of IDU in Ukraine and their HIV serostatus, as well as associations between serostatus and selected demographic and risk factors.

Methods

Study sample

The study was conducted with non-governmental organizations (NGOs) in three locations with high concentrations of IDU: Kiev, Odessa and Makeevka/Donetsk. Recruitment was conducted through street outreach in areas where IDU were known to congregate. Approximately 20 participants were recruited each month in each city over a 15-month period using outreach strategies based on the Indigenous Leader Outreach Model [13]. At the beginning of the project a 1-week centralized training was held for all staff, including outreach workers, interviewers, HIV testers/counselors and NGO directors. At each site, outreach workers were former drug injectors whereas the remaining staff members were not. Our experience, as well as that of others, supports indigenous outreach workers serving in this capacity [14,15]. Eligibility requirements included: self-reported drug injection in the previous 30 days; at least 18 years of age; not too intoxicated or otherwise incapacitated to comprehend and provide informed consent; and willingness to be interviewed for approximately 1 h and tested for HIV. Comprehension of informed consent was assessed using an eight-item questionnaire covering key items from the consent form (e.g., confidentiality). Drug injection was verified through visual inspection for signs of recent venipuncture. Eligibility criteria were reviewed initially by outreach workers with the final determination made by interviewers. Following the interview, participants were tested for HIV using the HIV I + II One-Step Test finger-stick rapid HIV test (Orgenics Ltd, Yavne, Israel). All participants were compensated the equivalent of US$ 3.00 for their time. Study procedures were approved by the Institutional Review Board (IRB) of the University of Colorado Health Sciences Center, which served as the IRB of record through a Federal-wide Assurance of Protection for Human Subjects.

Study instrument

Interviews were conducted by staff trained in the research protocol and comfortable working with drug users. Interviewers used an audio computer-administered self-interview (ACASI) adapted from the Risk Behavior Assessment (RBA) developed by a grantee consortium of NIDA during the 1990s. Reliability and validity assessments of the RBA support its use for this type of research with IDU [16,17]. The questionnaire was modified slightly for use in Ukraine, based on a series of focus groups conducted with IDU in Ukraine [9] and a review by NGO staff. The instrument was translated by an IRB-certified Russian translator in Denver. Translation accuracy was verified by Ukrainians fluent in Russian and English and adjustments made when necessary.

Variables assessed for their relationship to HIV status included: city, age, sex, ever arrested, ever received AIDS information or supplies, and a history of syphilis, gonorrhea, hepatitis B or hepatitis C. Drug risk behaviors included years injecting and the following variables queried for the 30 days prior to the interview: injected daily, always injected with others, injected stimulants, injected opiates, injected a sedative/opiate mix, used a previously used syringe, front/back loaded with a dealer, front/back loaded with other users, used drugs from a common container and used a preloaded syringe. Sex risks in the 30 days prior to the interview included whether or not the participant had sex, had sex without a condom, had more than one partner, had an IDU partner or had an HIV-positive partner.

Statistical analysis

Odds ratios and 95% confidence intervals are reported as measures of effect size for the relationship between each dichotomous variable and HIV status. For the two continuous variables, age and years injecting, one-way analysis of variance tests were conducted. Following these univariate tests, all variables were entered into a logistic regression with HIV status as the outcome variable. Dummy variables were created to dichotomize the three cities into yes/no responses. As the variable indicating the HIV status of the participants' sex partners contained so many 'don't know' responses, this variable was also dummy-coded to allow for the inclusion of all three categories (yes, no and don't know). Variables were assessed for potential multicollinearity and appropriate adjustments were made. Estimates of how well the model fit the observed data were based on the likelihood test [−2 times the log of the likelihood (−2LL)]. The Nagelkerke R^2 is reported as a measure of the amount of variation in the outcome variable that is explained by the logistic regression model. Variables that were significant ($P < 0.05$) in the final regression model are reported.

Results

Over a 15-month period, from June 2004 to August 2005, 891 individuals were recruited for participation,

Table 1. Frequencies for all variables among 891 injection drug users (IDU) in Ukraine.

Variable	Total *n*	Percentage or mean (SD)
Positive HIV status	891	33.2%
City	891	
Makeevka/Donetsk		33.6%
Kiev		33.4%
Odessa		33.0%
Age (mean)	891	28.9 (7.3)
Male sexr	891	77.9%
Ever arrested	891	63.4%
Ever received AIDS information or supplies	891	65.1%
Ever had syphilis	891	5.7%
Ever had gonorrhea	891	19.8%
Ever had hepatitis B	888	30.6%
Ever had hepatitis C	884	17.9%
Years injecting (mean)	888	10.2 (6.8)
Drug risks in the past 30 days		
Injected stimulants	891	54.5%
Injected opiates	891	51.5%
Injected sedative/opiate mix	891	41.3%
Injected daily (at least 30 times/month)	889	33.0%
Always injected with others	891	45.2%
Used a used syringe	888	21.6%
Front/back loaded with dealer	887	54.3%
Front/back loaded with other users	888	62.6%
Used a common container	886	37.2%
Used a preloaded syringe	887	17.8%
Sex risks in the past 30 days		
Had sex	888	80.6%
Had vaginal sex without a condom	890	38.4%
Had more than one sex partner	888	30.2%
Had an IDU sex partner	877	39.9%
Had an HIV positive sex partner	891	
Yes		8.2%
No		62.4%
Don't know		29.4%

one-third from each of the cities. Table 1 shows descriptive characteristics of the study sample, one-third of which tested positive for HIV. The mean age of the participants was 29 years and on average they had been injecting for about 10 years.

HIV infection

In order to provide a valid assessment of variables associated with HIV status, we omitted from further analyses the 113 participants who were aware that they were HIV positive prior to entering the study (and may have changed their behavior in response to their diagnosis). For the 778 participants who were unaware of their HIV status prior to participating in this research, analysis of variance of the two continuous variables (age and number of years injecting) indicated that those who were HIV positive were significantly older [31.5 versus 27.4 years; $F(1,772) = 47.2$, $P < 0.001$] and had been injecting longer [12.5 versus 8.8 years; $F(1,769) = 47.1$, $P < 0.001$] than those who were HIV negative. Odds ratios and 95% confidence intervals for the association between the variables in Table 1 and the participant's HIV status are reported in Table 2. Odessa had the largest percentage of HIV-positive participants and Makeevka/Donetsk the smallest. Females were more likely to be HIV positive as were those who had been arrested. Having had syphilis, hepatitis B or hepatitis C was associated with HIV infection. Sedative/opiate mixture was the only drug type predictive of HIV. Daily injecting was associated with being HIV positive, as was front/back loading with a dealer. Using a previously used syringe was not associated with HIV infection.

With regard to sexual risk behaviors, those who were abstinent were more likely to be HIV positive than those who were sexually active. Those who had an HIV-positive sex partner, however, were twice as likely to be HIV positive themselves as those who did not have an HIV-positive partner or who did not know the status of their partner. When data from those who did not know the status of their partner were combined with data from those who knew their partners were positive, they were much more likely to be HIV positive than those who knew that their sex partners were negative.

Multiple logistic regression of HIV infection

A logistic regression model was built using all of the variables above, including age and years injecting. The resulting model produced seven significant variables, with a $-2LL$ of 730.15 and an R^2 of 0.16. The significant variables, their adjusted odds ratios, confidence intervals and *P*-values are shown in Table 3. Variables are listed in the order in which they were entered into the model. Injecting a sedative/opiate mix, female sex, having had sex with a person who was HIV positive or whose HIV status was unknown, and injecting daily indicated an increased likelihood of being HIV positive. Variables that reflect a lower likelihood of HIV infection include being younger, from Makeevka/Donetsk and having had sex in the prior 30 days.

Discussion

Rates of HIV infection are high throughout Ukraine as evidenced from this investigation, although there is also variation across cities. Government figures on HIV prevalence also indicate large regional differences [4,18]. Our findings show HIV infection among drug injectors ranging from 17.4% in Makeevka/Donetsk to 32.6% in Kiev and 50.5% in Odessa. Further investigation into a possible explanation revealed that IDU in Odessa were older than those in the other sites (33.2 versus 26.2 in Makeevka/ Donetsk and 27.4 in Kiev, $P < 0.0001$) and they had been injecting longer (14.0 years versus 8.3 in Makeevka/ Donetsk and 8.4 in Kiev, $P < 0.0001$). Since age and years injecting were controlled for in the model this provides only a partial clarification. Studies in the US have shown mixed results regarding these factors, with some reporting newer injectors had lower HIV rates [19,20], whereas others suggest the opposite [21,22]. Regional differences in HIV-related risk factors, as well as

Table 2. Odds ratios and confidence intervals (CI) for associations between all variables and HIV status among 778 participants who were not HIV positive prior to entering the study.

Variable	*n*	HIV negative (%)	HIV positive (%)	Odds ratio	95% CI
City					
Makeevka/Donetsk				0.40	0.27–0.58[a]
No	491	70.5	29.5		
Yes	287	85.7	14.3		
Kiev				0.97	0.69–1.38
No	511	75.9	24.1		
Yes	267	76.4	23.6		
Odessa				2.50	1.77–3.53[a]
No	554	81.2	18.8		
Yes	224	63.4	36.6		
Sex				1.59	1.08–2.33[a]
Male	610	77.9	22.1		
Female	164	68.9	31.1		
Ever arrested				1.87	1.31–2.67[a]
No	304	82.6	17.4		
Yes	470	71.7	28.3		
Ever received AIDS info or supplies				1.39	0.98–1.97
No	299	79.6	20.4		
Yes	475	73.7	26.3		
Ever had syphilis				2.72	1.40–5.27[a]
No	736	77.0	23.0		
Yes	38	55.3	44.7		
Ever had gonorrhea				1.43	0.96–2.12
No	625	77.3	22.7		
Yes	149	70.5	29.5		
Ever had hepatitis B				1.67	1.17–2.38[a]
No	556	78.8	21.2		
Yes	216	69.0	31.0		
Ever had hepatitis C				1.80	1.17–2.77[a]
No	658	77.8	22.2		
Yes	112	66.1	33.9		
Drug risks in past 30 days					
Injected stimulants				0.92	0.66–1.29
No	342	75.1	24.9		
Yes	432	76.6	23.4		
Injected opiates				0.93	0.67–1.30
No	377	75.3	24.7		
Yes	397	76.6	23.4		
Injected sedative/opiate mix				1.69	1.22–2.37[a]
No	471	79.8	20.2		
Yes	303	70.0	30.0		
Injected daily (at least 30 times per month)				1.77	1.26–2.49[a]
No	525	79.6	20.4		
Yes	247	68.8	31.2		
Always injected with others				0.80	0.57–1.11
No	412	74.0	26.0		
Yes	362	78.2	21.8		
Used a used syringe				0.98	0.65–1.46
No	606	75.9	24.1		
Yes	165	76.4	23.6		
Front/back loaded with dealer				1.53	1.09–2.14[a]
No	378	80.2	19.8		
Yes	393	72.5	27.5		
Front/back loaded with others				1.27	0.90–1.80
No	291	78.7	21.3		
Yes	481	74.4	25.6		
Used common container				0.86	0.61–1.22
No	476	75.2	24.8		
Yes	294	77.9	22.1		
Used preloaded syringe				1.17	0.77–1.80
No	638	76.6	23.4		
Yes	133	73.7	26.3		
Sex risks in past 30 days					
Had sex				0.51	0.34–0.76[a]
No	136	64.7	35.3		
Yes	635	78.3	21.7		
Had vaginal sex w/o condom				0.87	0.62–1.22
No	466	74.9	25.4		
Yes	307	77.5	22.5		

Table 2 (*continued*)

Variable	*n*	HIV negative (%)	HIV positive (%)	Odds ratio	95% CI
More than one sex partner				0.83	0.58–1.19
No	528	74.8	25.2		
Yes	243	78.2	21.8		
IDU sex partner				1.07	0.76–1.50
No	463	76.2	23.8		
Yes	297	75.1	24.9		
HIV-positive sex partner				2.47	1.14–5.31[a]
No or do not know	746	76.7	23.3		
Yes	28	57.1	42.9		
HIV-positive sex partner				1.69	1.21–2.37[a]
No	505	79.4	20.6		
Yes or do not know	269	69.5	30.5		

[a]Indicates that the confidence interval does not include 1, an indication of the 'significance' of the relationship.

drug preferences, have been observed in the US as well, with calls for further examination of social and environmental factors that may account for these differences [23,24]. Another explanation may be that the first reported HIV cases were from Odessa, allowing more time for the virus to spread. Some researchers believe that once the virus reaches a prevalence of 10–20% in an area, the incidence increases exponentially [25]. If correct, this suggests the potential for a rapid increase in HIV rates in Kiev and Makeevka/Donetsk without the help of interventions to reduce risk behaviors.

Several other noteworthy findings were also observed. First, females were more likely to be infected with HIV than males. Prior investigations with IDU have also noted the significance of female sex in accounting for higher rates of both HIV incidence [26,27] and prevalence [28]. Second, two drug-related variables were significantly, and independently, associated with HIV infection. These included injecting daily and injecting a sedative/opiate mixture. Others have reported that injection frequency among IDU, including daily injection [29], independently predicted HIV infection [30,31]. The relationship between injecting a sedative/opiate mixture and HIV may be explained by several inter-related factors. According to the staff involved in the study, this drug combination is extremely strong. IDU have experienced very negative consequences associated with its use, including seizures and dementia, and thus they neglect to practice safer behaviors. In addition, the mixture is usually prepared in a common container used by several injectors.

Finally, two sex-related variables were associated with HIV serostatus. Those who were sexually active were less likely to be infected than those who did not have sex. This suggests the possibility that those who tested positive may have been suspicious that they might be infected and therefore refrained from sexual contact. On the other hand, participants who were HIV positive were more likely to report sex with another HIV-infected individual or sex with someone whose HIV status was unknown, thus increasing the likelihood of re-infection.

Although we hesitate to infer too much from null findings, we were somewhat surprised to find that using a used needle was not related to HIV status. A possible explanation is that only 4.5% reported engaging in this risk behavior without cleaning their needle first (data not shown). Other needle-related risk factors (e.g., front/back loading with a dealer, injecting sedatives/opiates) appear more threatening to drug injectors in Ukraine.

There are several limitations that should be considered when drawing conclusions from this study. First, the sampling plan was designed to access IDU from areas throughout each city so that findings could be representative of street-based drug injectors in those locations. Although this approach is preferable to convenience sampling, it is not known how representative the three samples were of IDU in each city. As reported by outreach workers, there were few refusals to participate. However, it is not possible to know the number or characteristics of those who refused to

Table 3. Logistic regression model of variables significantly associated with HIV-positive status.

Variable	Adjusted OR	95% CI	*P*-value
Younger age	0.94	0.92–0.97	<0.000
From Makeevka/Donestk	0.63	0.41–0.95	0.026
Injected a sedative/opiate mix	1.63	1.13–2.35	0.009
Female sex	1.77	1.16–2.69	0.008
Sex with an HIV-positive person or one whose status was unknown	2.04	1.35–3.07	0.001
Had sex	0.47	0.29–0.76	0.002
Injected daily	1.49	1.03–2.17	0.036

OR, odds ratio; CI, confidence interval.

participate. It is likely that the sample over-represents IDU willing to spend the time necessary to participate in a research study and motivated by the modest stipend. Thus, this study does not purport to generalize to all IDU, but to a relatively representative sample of street-recruited IDU, who were probably more impoverished and in worse health than other drug users in Ukraine. Second, the majority of the data reported here were based on self-reports, which potentially could be biased due to recall errors and social desirability. Recall error should have been diminished by the relatively brief time period respondents were asked to remember (i.e., 30 days). As IDU in Ukraine are less familiar with research practices than IDU in the US and elsewhere, it is unclear what influence social desirability might have played. Although social desirability cannot be ruled out, it is unlikely that the main findings were influenced by this factor. In addition, prior studies have shown that drug users' self-reports are sufficiently valid for this type of research [32,33].

The rapid increase in injection drug use and HIV in Ukraine following the collapse of the Soviet Union was remarkable but perhaps not surprising. The resulting deterioration of the economic and social fabric of the country created a vacuum in which illicit drug use flourished. As this study revealed, HIV is at extremely high levels in Ukraine, due in large measure to drug injection. There is, unfortunately, increasing evidence that the epidemic is now moving to non-injectors through sexual transmission [1]. Behavioral interventions, along with antiretroviral medications, are urgently needed.

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